PARTIAL COPY

TRANSPORTATION ANALYSES
of
THE
STATE ROUTE 238 CORRIDOR IMPROVEMENT PROJECT

Prepared for

THE CITY OF HAYWARD

BY

Dowling Associates, Inc.
Oakland, CA

November 13, 2003

November 13, 2003

Mr. Jim Sims
Division Manager
Mark Thomas & Co. Inc
6920 Koll Center Parkway, Suite 219
Pleasanton, CA 94566

Subject: Route 238 Corridor Improvement Traffic Study P03-0039

Dear Mr. Sims:

Dowling Associates is pleased to present this report on the traffic analysis for the Route 238 Corridor Improvement Project.

I would like to credit the numerous staff members of Dowling Associates who put in extra long hours to perform the traffic analyses documented in this report. Mr. Marty Beene was project manager and project engineer for this project. Mr. Mark Bowman performed the TRAFFIX™ level of service computations. Mr. Allen Huang performed the VISSIM analyses, often working very late hours to produce the results.

As you may recall, the City of Hayward EMME2 Travel Demand model was completed by others and delivered to us 10 weeks late. Our own review of the model discovered that it was missing the widened "D" Street, which required some extra time to add it and revalidate the model.

Despite these delays, the Dowling staff produced a rough first draft of this traffic report complete with VISSIM analyses in time for the City's September 2003 meeting of their project working group. Many rough spots were identified in the VISSIM and TRAFFIX™ analyses at that time which have been ironed out in a cooperative team effort with City staff over the intervening weeks leading up to the November working group meeting.

I would like to give a great deal of thanks to city staff for their extensive efforts reviewing our rough work products on a timely basis (without waiting for us to polish and error check them). We could not have delivered this report in a timely manner without the City's constructive help to overcome the initial delay. Mr. Robert Bauman and Ms. Roxy Carmichael-Hart were very helpful and patient in their reviews.

Sincerely,
Dowling Associates

Richard G. Dowling, Ph.D., P.E.
Principal

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List of Exhibits

I. Introduction

The purpose of this report is to document the traffic forecasting and traffic operations analysis for the Route 238 Corridor Improvement Project. The study area involves the corridor defined by Foothill Boulevard south of Mattox/Castro Valley to the Foothill/Jackson/Mission intersection; then Mission Boulevard south to Industrial Parkway.

Description of Analysis Scenarios

The traffic analysis focuses on three analysis scenarios: Existing Conditions, Year 2025 No-Project, and Year 2025 With Project. The major street improvements under each analysis scenario are summarized in Exhibit 1.

The 2025 No-Project scenario includes signal timing optimization for the future demand levels plus a few street improvements at individual intersections that are expected to be built by the year 2025 in the absence of the Corridor Improvement project:

- Northbound left-turns will be permitted at B Street
- Northbound and southbound left-turns will be permitted at C Street
- Tennyson Street will be extended to the east of Mission Blvd and the existing La Vista Quarry intersection with Mission will no longer be signalized.
- A second westbound left turn lane will be added to Castro Valley at Foothill.
- A second westbound left turn lane and a second southbound left turn lane will be added at Carlos Bee and Mission.

The 2025 Project scenario includes the Mission/Jackson/Foothill Grade Separation, some side street closures, and signal timing optimization for the corridor. Left turns will be permitted from Foothill at “A” and “D” Streets in addition to left turns that will be permitted from Foothill at “B” and “C” Streets under the No-Project Scenario.

Exhibit 2 shows the specific changes to intersection lane geometries for each scenario. It is presented in a very dense format to allow all the lane geometries for each scenario to be summarized in three pages.

A sequence of 6 digits is given for each approach which show, from left to right, the number of left turn lanes (first digit), shared left-through lanes (second digit), through lanes (third digit), shared through-right lanes (fourth digit), right turn lane (fifth digit), shared left-through-right lanes (last digit). For example, for the southbound (SB) approach of the intersection of Foothill and Mattox, the exhibit shows the code “302100” for existing conditions. This six digit code means that this approach currently has 3 left turn lanes, no shared left-through lanes, 2 through lanes, 1 shared through-right lane, no right turn lanes, and no shared left-through-right lanes.

Exhibit 1. Corridor Geometry for Existing, No-Project, and Project Scenarios

	Existing		2025 No Project		2025 Reduced ROW		2025 With Project	
Intersection	Thru Lanes	Left-Lanes	Thru Lanes	Left-turn Lanes	Thru Lanes	Left-turn Lanes	Thru Lanes	Left-turn Lanes
Foothill & Mattox		Both		Both		Both		Both
	3		3		3 / 4**		3 / 4**	
Foothill & Grove		Both		Both		Both		Both
	3		3		3		4	
Foothill & Hazel		Both		Both		Both		Both
	3		3		3		4	
Foothill & City Ctr		Both		Both		Both		Both
	3		3		3		4	
Foothill & Russell		SB		SB		Closed		Closed
	3		3		3		4	
Foothill & A		None		None		Both		Both
	3		3		4		5	
Foothill & B		None		NB		NB		NB
	3		3		4		5	
Foothill & C		None		Both		Both		Both
	3		3		4		5	
Foothill & D		None		None		SB		SB
	3		3		4		5	
Foothill/Mission/Jackson		*		*		Grade Sep.		Grade Sep.
	2/3		2/3		4		4	
Mission & Fletcher		Both		Both		Both		Both
	3		3		3		4	
Mission & Highland		Both		Both		Both		Both
	2		2		3		4	
Mission & Carlos Bee		Both		Add 2nd SB/WB		Add 2nd SB/WB		Add 2nd SB/WB
	2		2		3		4	
Mission & Central		Both		Both		None		None
	2		2		3		4	
Mission & Berry		NB		NB		NB		NB
	2		2		3		4	
Mission & Torrano		SB		SB		SB		SB
	2		2		3		4	
Mission & Harder		Both		Both		Both		Both
	2		2		3		3	
Mission & Sorenson		NB		NB		NB		NB
	2		2		3		3	
Mission & Jefferson/Calhoun		Both		Both		Both		Both
	2		2		3		3	
Mission & Hancock		Both		Both		Both		Both
	2		2		3		3	
Mission & Tennyson		NB		Both		Both		Both
	2		2		3		3	
Mission & La Vista Quarry		Both		None		None		None
	2		2		3		3	
Mission & Valle Vista		Both		Both		NB		NB
	2		2		3		3	
Mission & Industrial		Both		Both		Both		Both

*Lefts permitted from WB Foothill onto SB Mission and from EB Jackson onto NB Mission
**Expansion to 4 through lanes at Apple/I-580/I-238 Ramps

Exhibit 2. Scenario Intersection Lane Geometries

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Dowling Associates, Inc. -- Highway 238 -- P 03039
Lane Geometry Scenario Comparison Report

Number of approach lanes: (L) (LT) (T) (RT) (R) (LTR)
(Approach blank if no change)

Node	Intersection	Scenario	NB	SB	EB	WB
1	Foothill & Mattox	Existing_	200020	302100	002100	102000
1	Foothill & Mattox	NoProject_				202000
1	Foothill & Mattox	Red. ROW				
1	Foothill & Mattox	Project_				
2	Foothill & Grove	Existing_	102100	102100	100100	101010
2	Foothill & Grove	NoProject_				
2	Foothill & Grove	Red. ROW	102100	102100		
2	Foothill & Grove	Project_	103100	103100		
3	Foothill & Hazel	Existing_	102100	102100	100100	101010
3	Foothill & Hazel	NoProject_				
3	Foothill & Hazel	Red. ROW	102100	102100		
3	Foothill & Hazel	Project_	103100	103100		
4	Foothill & City Center	Existing_	103010	103010	101100	100110
4	Foothill & City Center	NoProject_				
4	Foothill & City Center	Red. ROW	102100	102100		
4	Foothill & City Center	Project_	103100	103100		
5	Foothill & Russell	Existing_	002100	103000	000000	000020
5	Foothill & Russell	NoProject_				
5	Foothill & Russell	Red. ROW	003000	003000		000000
5	Foothill & Russell	Project_	004000	004000		000000
6	Foothill & A	Existing_	002100	002100	101100	101100
6	Foothill & A	NoProject_				
6	Foothill & A	Red. ROW	103010	103100		
6	Foothill & A	Project_	104010	104100		
7	Foothill & B	Existing_	003000	002100	000000	111010
7	Foothill & B	NoProject_	103000			
7	Foothill & B	Red. ROW	104000	003100		
7	Foothill & B	Project_	105000	004100		
8	Foothill & C	Existing_	003010	003000	111010	000000
8	Foothill & C	NoProject_	102100	102100	011010	
8	Foothill & C	Red. ROW	103100	103100	110100	
8	Foothill & C	Project_	104100	104100	110100	
9	Foothill & D	Existing_	002100	002100	111000	201100
9	Foothill & D	NoProject_			110100	
9	Foothill & D	Red. ROW	004010	104100		
9	Foothill & D	Project_	004100			
10	Mission/Foothill/Jackson	Existing_	002020	001110	202100	301100
10	Mission/Foothill/Jackson	NoProject_				
10	Mission/Foothill/Jackson	Red. ROW	002000	002010	100000	300000
10	Mission/Foothill/Jackson	Project_				

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Lane Geometry Scenario Comparison Report

Number of approach lanes: (L) (LT) (T) (RT) (R) (LTR)
(Approach blank if no change)

Node	Intersection	Scenario	NB	SB	EB	WB
11	Jackson & Watkins	Existing_	102100	101100	010010	000001
11	Jackson & Watkins	NoProject_				
11	Jackson & Watkins	Red. ROW	000001	000001		100100
11	Jackson & Watkins	Project_				
12	Mission & Fletcher	Existing_	102100	102100	010010	100100
12	Mission & Fletcher	NoProject_				
12	Mission & Fletcher	Red. ROW	103100	102100		
12	Mission & Fletcher	Project_	104100	103100		
13	Mission & Highland	Existing_	101100	101100	010010	010010
13	Mission & Highland	NoProject_				
13	Mission & Highland	Red. ROW	102100	102100	100100	100100
13	Mission & Highland	Project_	103100	103100		
14	Mission & Carlos Bee	Existing_	101100	102010	102010	102010
14	Mission & Carlos Bee	NoProject_	102010	202010	201100	202010
14	Mission & Carlos Bee	Red. ROW	102100	202100		
14	Mission & Carlos Bee	Project_	103100	203100		
15	Mission & Central	Existing_	001100	102000	000000	000001
15	Mission & Central	NoProject_				
15	Mission & Central	Red. ROW	002100	003000		000010
15	Mission & Central	Project_	003100	004000		
16	Mission & Berry	Existing_	102000	001100	000001	000000
16	Mission & Berry	NoProject_				
16	Mission & Berry	Red. ROW	103000	002100		
16	Mission & Berry	Project_	104000	003100		
17	Mission & Torrano	Existing_	001100	101100	000001	000001
17	Mission & Torrano	NoProject_				
17	Mission & Torrano	Red. ROW	002100	102100	000010	
17	Mission & Torrano	Project_	003100	103100		
18	Mission & Harder	Existing_	102010	102010	111010	111010
18	Mission & Harder	NoProject_				
18	Mission & Harder	Red. ROW	102100	102100		
18	Mission & Harder	Project_			202010	202010
19	Mission & Sorenson	Existing_	102000	001100	100001	000000
19	Mission & Sorenson	NoProject_				
19	Mission & Sorenson	Red. ROW	103000	002100		
19	Mission & Sorenson	Project_				
20	Mission & Jefferson/Calhoun	Existing_	101100	101100	000001	000001
20	Mission & Jefferson/Calhoun	NoProject_				
20	Mission & Jefferson/Calhoun	Red. ROW	102100	102100	100100	100100
20	Mission & Jefferson/Calhoun	Project_				

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Lane Geometry Scenario Comparison Report

Number of approach lanes: (L) (LT) (T) (RT) (R) (LTR)

(Approach blank if no change)

Node	Intersection	Scenario	NB	SB	EB	WB
22	Mission & Hancock	Existing_	101100	101100	000001	000001
22	Mission & Hancock	NoProject_				
22	Mission & Hancock	Red. ROW	102100	102100		
22	Mission & Hancock	Project_				
23	Mission & Tennyson	Existing_	202000	003010	200010	000000
23	Mission & Tennyson	NoProject_	201100	103010	200100	101100
23	Mission & Tennyson	Red. ROW	202100		201010	101010
23	Mission & Tennyson	Project_				
24	Mission & La Vista Quarry	Existing_	101100	102100	000001	000001
24	Mission & La Vista Quarry	NoProject_	No Intersection			
24	Mission & La Vista Quarry	Red. ROW	No Intersection			
24	Mission & La Vista Quarry	Project_	No Intersection			
25	Mission & Valle Vista	Existing_	101100	101100	000001	000001
25	Mission & Valle Vista	NoProject_				
25	Mission & Valle Vista	Red. ROW	102100	102100		
25	Mission & Valle Vista	Project_				
26	Mission & Industrial	Existing_	202100	102100	201110	102010
26	Mission & Industrial	NoProject_				
26	Mission & Industrial	Red. ROW				
26	Mission & Industrial	Project_				

If the lane geometry does not change between the existing and no-project scenarios, then the no-project row is left blank for that particular approach. If the lane geometry does not change between the no-project and project scenarios, then the “project” row for that approach is left blank. Signal timings are shown in the TRAFFIX™ outputs in the Technical Appendix.

II. Traffic Forecasting

This chapter documents the process used to develop the traffic forecasts for the Hayward Route 238 Corridor Improvement Project.

The City of Hayward Planning Area EMME2 travel demand model was used to develop the traffic demand forecasts. The City of Hayward model was recently updated to ABAG Projections 2000 for the base year 2000 and Projections 2002 for the year 2025 forecasts. The model was validated to a system of 10 screenlines with recent counts for the AM and PM peak hour time periods.

The city model was reviewed, refined, and revalidated within the Route 238 corridor. Minor coding errors in the original model (turn penalties, number of lanes, etc.) were identified and corrected. The refined model was then revalidated within the Route 238 corridor.

The revalidated model was then used to forecast the Year 2025 AM and PM peak hour traffic demands for the corridor. The link level traffic demands were then used to estimate the AM and peak hour turning movements for each of the 26 analysis intersections in the corridor. A Furness adjustment process (explained below) was used to convert model link level forecasts into future turning movements.

Traffic Counts

AM and PM peak hour counts were assembled for 25 intersections from city files or counted in the field by Dowling Associates and Pang Ho Associates (see Exhibit 3 below). Most of the new counts were made in May 2003. Some counts, which could not be made in May were made in June and July, 2003 during school summer vacation. The counts obtained from city files ranged from September 1999 to June 2002.

Because the counts were made over a variety of years and included counts made during school summer vacation, it was necessary to compare the counts at adjacent intersections of the corridor and balance them for discrepancies in the counted volumes on Mission and Foothill Boulevard. The final balanced counts are documented in the Technical Appendix along with the TRAFFIX™ results.

The balanced counts were used to check the validation of the city demand model for the corridor and in the Furness process used to compute future turning movements from the city demand model link forecasts for the no-project and project scenarios.

Exhibit 3. Intersection Count Dates

ID	Street 1	Street 2	AM Traffic Count Date	AM Source	PM Traffic Count Date	PM Source
1	Foothill	Mattox	05/20/2003	PHA	05/20/2003	PHA
2	Foothill	I-580 On-Ramp	**06/24/2003**	**Dowling**	**06/24/2003**	**Dowling**
3	Foothill	Grove	**07/09/2002**	**City**	**06/24/2003**	**Dowling**
4	Foothill	Hazel / City Center	05/20/2003	PHA	05/20/2003	PHA
5	Foothill	City Center	05/20/2003	PHA	05/20/2003	PHA
6	Foothill	Russell	**06/25/2003**	**Dowling**	**06/25/2003**	**Dowling**
7	Foothill	A	**02/16/2000**	**City**	**02/16/2000**	**City**
8	Foothill	B	**02/16/2000**	**City**	**02/16/2000**	**City**
9	Foothill	C	**02/16/2000**	**City**	**02/16/2000**	**City**
10	Foothill	D	05/20/2003	PHA	05/20/2003	PHA
11	Foothill / Mission	Jackson	05/14/2003 10/09/2003	PHA	10/09/2003	PHA
12	Mission	Fletcher	05/20/2003	PHA	05/20/2003	PHA
13	Mission	Highland	05/20/2003	PHA	05/20/2003	PHA
14	Mission	Carlos Bee	05/14/2003	PHA	**June 2001**	**City**
15	Mission	Central	05/20/2003	PHA	05/20/2003	PHA
16	Mission	Berry	05/13/2003	PHA	05/13/2003	PHA
17	Mission	Torrano	05/13/2003	PHA	05/13/2003	PHA
18	Mission	Harder	05/14/2003	PHA	**June 2001**	**City**
19	Mission	Sorenson	05/13/2003	PHA	05/13/2003	PHA
20	Mission	Calhoun / Jefferson	**06/12/2002**	**City**	**06/12/2002**	**City**
21	Mission	Hancock	05/14/2003	PHA	**09/18/1999**	**City**
22	Mission	Tennyson	05/14/2003	PHA	**June 2001**	**City**
23	Mission	La Vista Quarry	**06/24/2003**	**Dowling**	**06/24/2003**	**Dowling**
24	Mission	Valle Vista	05/13/2003	PHA	05/13/2003	PHA
25	Mission	Industrial	05/14/2003	PHA	**12/05/2000**	**City**
26	Jackson	Watkins	06/03/2003	City	06/03/2003	City

Bold Entries indicate older counts or counts made during school summer vacation

Our initial review of the traffic count history at the intersection of Foothill/Jackson and Mission found that the Year 2001 PM Peak hour counts were significantly higher than the May 2003 counts at adjacent intersections. Consequently the intersection was recounted in October 2003 to verify the year 2003 volumes for this intersection. Both AM and PM peak hours were recounted and it was found that the AM peak hour in October was about 12% higher than in May, and the PM peak hour was about 1% higher than the May 2003 counts at adjacent intersections. The new counts were used to report the current level of service at this intersection, however; in order to maintain consistency with the other Spring 2003 counts in the corridor, the balanced May 2003 counts were used at this intersection for the VISSIM calibration process and the Hayward Demand Model validation.

The specific adjustments made to the counts at each intersection are listed and explained in The Technical Appendix.

Model Refinement/Revalidation

As part of the Hayward 238 Corridor Improvement Project, the City Model was reviewed in the corridor and elements of the model were adjusted based on existing conditions. These elements include:

1. Land use data was adjusted for select TAZs in the existing and future models based on corrected information from City staff. Land use totals remained the same as the adjustment involved simply moving households from select TAZs to neighboring TAZs.
2. Network corrections were made in the corridor based on city input, including D Street widening from 2 to 4 lanes, and reducing Watkins from 2 lanes southbound to one lane in each direction. Other changes included correcting First Street to a one-way street south of C Street and C Street was changed to two-way from Watkins Avenue to Foothill Boulevard in the future network based on proposed changes planned by the city.
3. Turn penalties were added into the year 2000 existing model to simulate the existing turn prohibitions observed on Foothill Boulevard to selected cross streets.
4. Turn penalties were added accordingly in the future 2025 model to simulate different turning conditions in the 238 corridor due to street closures, median closures and turn permissions that will be different to existing.
5. TAZ (traffic analysis zone) connectors were adjusted at select locations in downtown to reflect the absence of mid-block loading points.
6. TAZ connectors were added in future conditions to Tennyson Road Extension and Alquire Parkway to simulate new connections.

Based on the above changes, the existing model was revalidated to existing counts obtained from the 24 study intersections (combined turn counts were summed to create link counts). The revalidated model was compared to the balanced counts at the study intersections and the model results were used in the Furness incremental adjustment process.

The EMME2 model validation results for the AM and PM peak hours are shown in the Technical Appendix. The model predicted the total existing AM peak hour traffic within 7% for the north-south direction of the corridor, and within one percent for the east-west streets in the corridor.

The model predicted the total existing PM peak hour traffic within 7% for the north-south direction of the corridor, and within 13% for the east-west streets in the corridor. The model predictions for individual streets had higher variations.

Traffic Forecast Results

The demand model predicts that peak hour travel demand in the corridor will increase by 33% between 2003 and 2025 under the "no-project" scenario (see Exhibit 4 below). Peak hour travel in the corridor is defined here as the sum of the intersection volume totals, The proposed Corridor Improvement project would increase peak hour travel demand in the corridor by 62% to 67% between 2003 and 2025.

The travel increases related to the corridor improvement project are however, a result of redistribution of traffic from other more congested potential routes, which is not the same thing as what is sometimes called induced demand. A plot of the differences in the predicted Year 2025 AM peak hour traffic volumes for the project and no-project scenarios (see Exhibit 5) shows that the increased demand on the corridor improvement project results from reduced demand on both other north south routes and east west routes serving the corridor.
A general analysis of total amount of traffic entering the corridor at either end and at the cross streets indicates almost no change between the project and no-project scenarios which shows that more vehicles are taking longer trips in the corridor. As a result several north-south and east-west city streets within Hayward would see reductions (compared to Year 2025 no-project) as the corridor improvement project retains traffic within the corridor. Even the I-880 freeway would see a modest reduction in traffic (compared to no-project) with the corridor improvement project.

The Hayward Travel Demand Model predicts that total vehicle-miles traveled in the Hayward area (the quadrangle containing all of the streets and freeways shown in Exhibit 5) during the AM and PM peak hours will increase 36% between the year 2000 and 2025 under both the no-project and project scenarios (see Exhibit 6).

Total vehicle-hours traveled during the peak hours will increase 67% between 2000 and 2025 under the no-project scenario. The proposed project would reduce this increase to 63%.

The mean speed of traffic during the peak hours would drop 19% between 2000 and 2025 under the no-project scenario. The proposed project would reduce this decrease in mean speed to 17%.

The total number of centerline miles that are congested would increase 179% between 2000 and 2025 under the no-project scenario. The proposed project would reduce this increase in congestion to 141%.

Exhibit 4. Summary of AM and PM Peak Hour Traffic Forecast Results

	AM Peak Hour					PM Peak Hour				
East/West	Existing	No-Project	Growth	Project	Growth	Existing	No-Project	Growth	Project	Growth
MATTOX	4,150	6,282	51%	6,780	63%	4,482	6,491	45%	6,813	52%
GROVE	5,205	7,095	36%	8,364	61%	5,581	7,626	37%	8,797	58%
HAZEL	4,668	6,204	33%	7,568	62%	5,075	6,717	32%	7,965	57%
CITY CTR	4,389	5,552	26%	7,008	60%	4,734	6,058	28%	7,390	56%
RUSSELL	3,480	4,690	35%	6,003	73%	3,933	5,170	31%	6,323	61%
A STREET	5,336	7,671	44%	9,578	79%	5,835	8,021	37%	9,717	67%
B STREET	4,921	6,997	42%	9,130	86%	5,047	7,288	44%	9,044	79%
C STREET	4,607	6,504	41%	8,793	91%	5,056	7,525	49%	9,424	86%
D STREET	6,332	8,467	34%	10,916	72%	5,998	7,954	33%	10,854	81%
JACKSON	6,625	8,992	36%	10,898	64%	7,277	9,863	36%	11,487	58%
WATKINS	3,814	5,579	46%	5,595	47%	4,076	5,865	44%	5,509	35%
FLETCHER	4,268	5,525	29%	7,647	79%	4,608	5,980	30%	7,987	73%
HIGHLAND	3,946	5,115	30%	7,290	85%	4,361	5,656	30%	7,680	76%
CARLOS B	5,170	6,750	31%	9,013	74%	4,860	6,491	34%	8,616	77%
CENTRAL	3,499	4,819	38%	7,037	101%	3,479	4,489	29%	6,558	89%
BERRY	3,382	4,473	32%	6,685	98%	3,314	4,473	35%	6,553	98%
TORRANO	3,425	4,528	32%	6,755	97%	3,357	4,548	35%	6,643	98%
HARDER	4,652	6,116	31%	8,075	74%	4,634	6,102	32%	8,099	75%
SORENSON	3,883	5,107	32%	6,673	72%	4,177	5,412	30%	6,885	65%
JEFFERSON	4,041	5,118	27%	0	-100%	4,048	4,961	23%	0	-100%
CALHOUN	3,677	4,307	17%	6,925	88%	3,900	4,474	15%	6,919	77%
HANCOCK	3,664	4,338	18%	6,086	66%	4,067	4,674	15%	6,521	60%
TENNYSON	4,189	5,810	39%	7,300	74%	4,587	6,281	37%	7,532	64%
LA VISTA	3,314	4,127	25%	5,745	73%	3,551	4,476	26%	6,118	72%
VALLE VISTA	3,332	4,005	20%	5,344	60%	3,480	4,259	22%	5,618	61%
INDUSTRIAL	4,410	5,680	29%	6,435	46%	4,551	5,878	29%	6,746	48%
	112,379	149,851	33%	187,643	67%	118,068	156,732	33%	191,798	62%

Notes:
1. Growth = The ratio of the future traffic forecast (either no-project or project) to existing traffic minus one.
2. Table represents balanced volumes for existing and Furness adjusted demand model volumes for the two future scenarios, no-project and project.

Exhibit 5. Difference Plot 2025 Project Versus No-Project

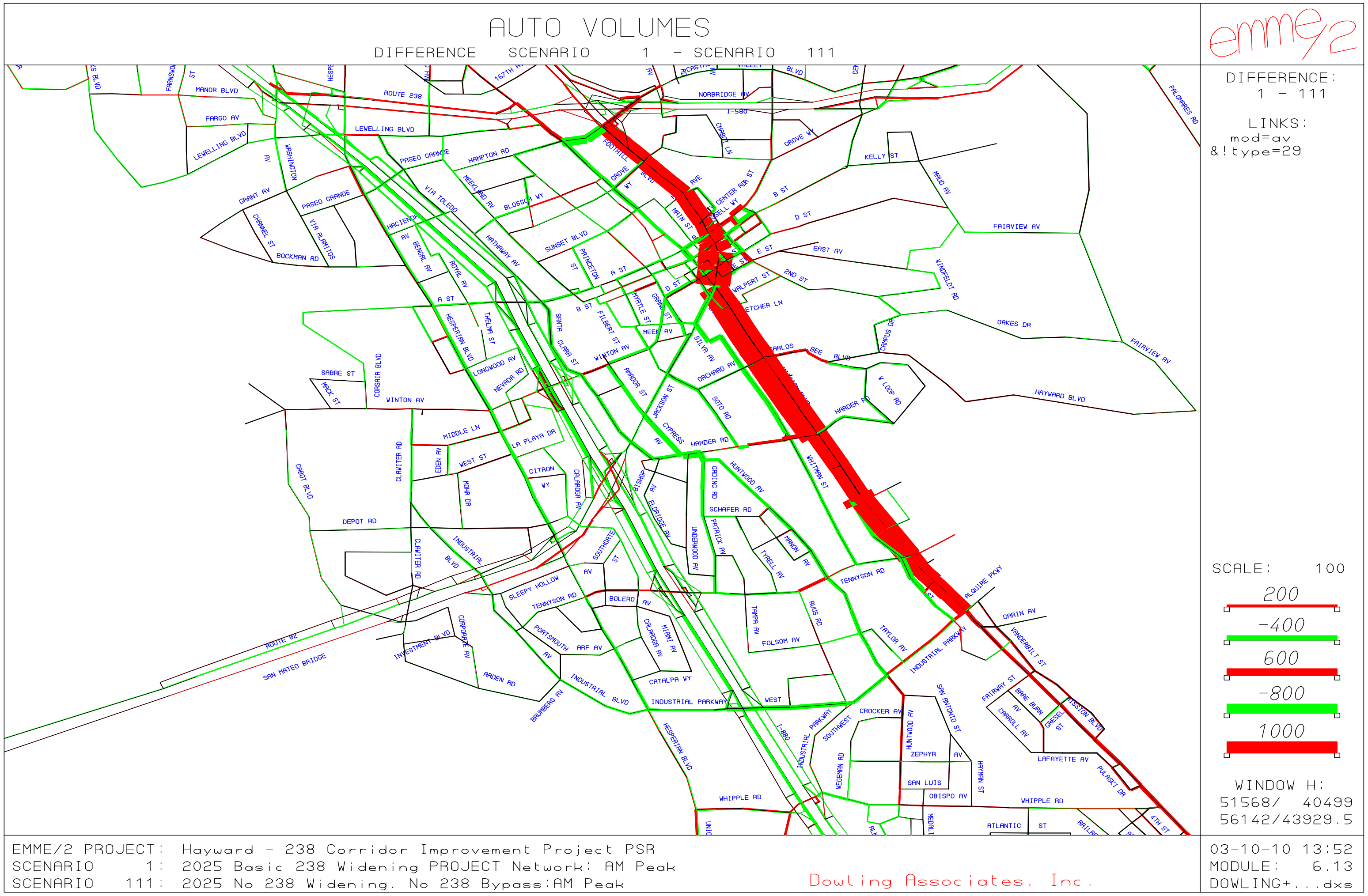


Exhibit 6. Hayward Demand Model Results

Forecast	**VMT** (miles)	**VHT** (hours)	**Speed** (mph)	**Congestion** (miles)	**Total Road** (miles)	**Percent Congested**
2000 Model						
AM Peak Hour	399,616	12,567	31.8	32.6	404	8%
PM Peak Hour	403,534	12,347	32.7	31.8	404	8%
sum	**803,150**	**24,914**	**32.2**	**64.4**		
2025 No-Project						
AM Peak Hour	543,915	21,001	25.9	87.1	414	21%
PM Peak Hour	547,484	20,713	26.4	92.3	414	22%
sum	**1,091,399**	**41,714**	**26.2**	**179.4**		
2025 Basic Project						
AM Peak Hour	543,840	20,456	26.6	73.4	414	18%
PM Peak Hour	546,819	20,214	27.1	81.9	414	20%
sum	**1,090,659**	**40,670**	**26.8**	**155.3**		
2025 Basic Project with Flyover						
AM Peak Hour	544,389	20,478	26.6	76.4	415	18%
PM Peak Hour	545,753	20,140	27.1	80.3	415	19%
sum	**1,090,142**	**40,618**	**26.8**	**156.7**		
2025 REDUCED ROW Scenario						
AM Peak Hour	544,922	20,665	26.4	80.2	414	19%
PM Peak Hour	547,047	20,311	26.9	85.1	414	21%
sum	**1,091,969**	**40,976**	**26.7**	**165.3**		

VMT = Vehicle-Miles Traveled

VHT = Vehicle-Hours Traveled

Congestion = Directional Miles of Road with V/C > 1.0

Impacts of Reduced Right of Way Scenario

The reduced right-of-way (ROW) scenario as the name implies tries to improve congestion in the corridor without requiring as much right of way. It does still include the grade separation. Exhibit 2 compares the corridor geometry under the project scenario to the reduced ROW scenario. Traffic forecasts and analysis were performed for the reduced ROW scenario.

Exhibit 7 shows how the reduced ROW project scenario would affect the AM peak hour volume forecasts in comparison to the base project for streets in the Hayward area (green means the volume would be less than for the base project, red means the volume would be higher than for the base project). The reduced ROW scenario would result in lower peak hour volumes on Mission and Foothill, particularly in the central portion of the corridor, than the base project although there are corresponding increases on other parallel streets within the corridor.

The reduced ROW scenario will be less effective at reducing congestion within the Hayward area than the base project. The reduced ROW project will still significantly improve mean speed and the number of congested miles of roadway in the area, increasing the mean speed during the peak hours from 26.2 to 26.7 mph (see Exhibit 6). The miles of congestion during the peak hours is reduced from 179.4 to 165.3.

Impacts of I-580/Foothill Flyover

This scenario is essentially the same as the basic project except it includes a two-lane flyover ramp from WB I-580 just east of Strobridge to southbound Foothill north of Grove Way. Traffic forecasts and analysis were performed for this flyover scenario.

Exhibit 8 shows how the flyover project scenario would affect the AM peak hour volume forecasts in comparison to the base project for streets in the Hayward area (green means the volume would be less than for the base project, red means the volume would be higher than for the base project). The flyover will impact primarily the north end of the corridor and will have minor impacts elsewhere. The flyover scenario would result in lower peak hour volumes in the westbound direction on Castro Valley Blvd and Grove Way compared to the base project.

The flyover scenario would be very similar in reducing congestion within the Hayward area compared to the base project as can be seen in Exhibit 6.

Exhibit 7. Impact of Reduced Right-of-Way Project Scenario on Base Project 2025 Forecasted AM Peak Hour Volumes.

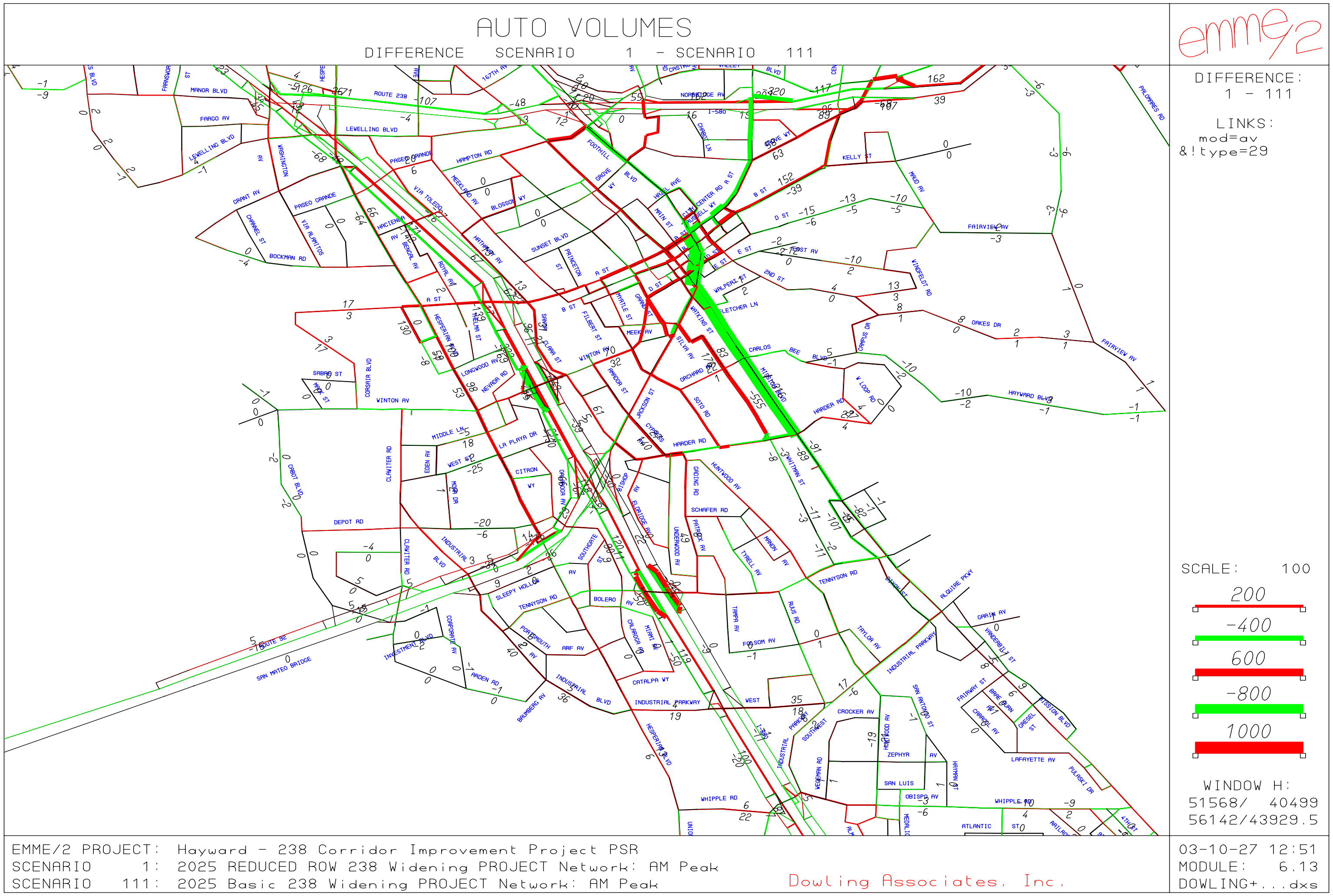
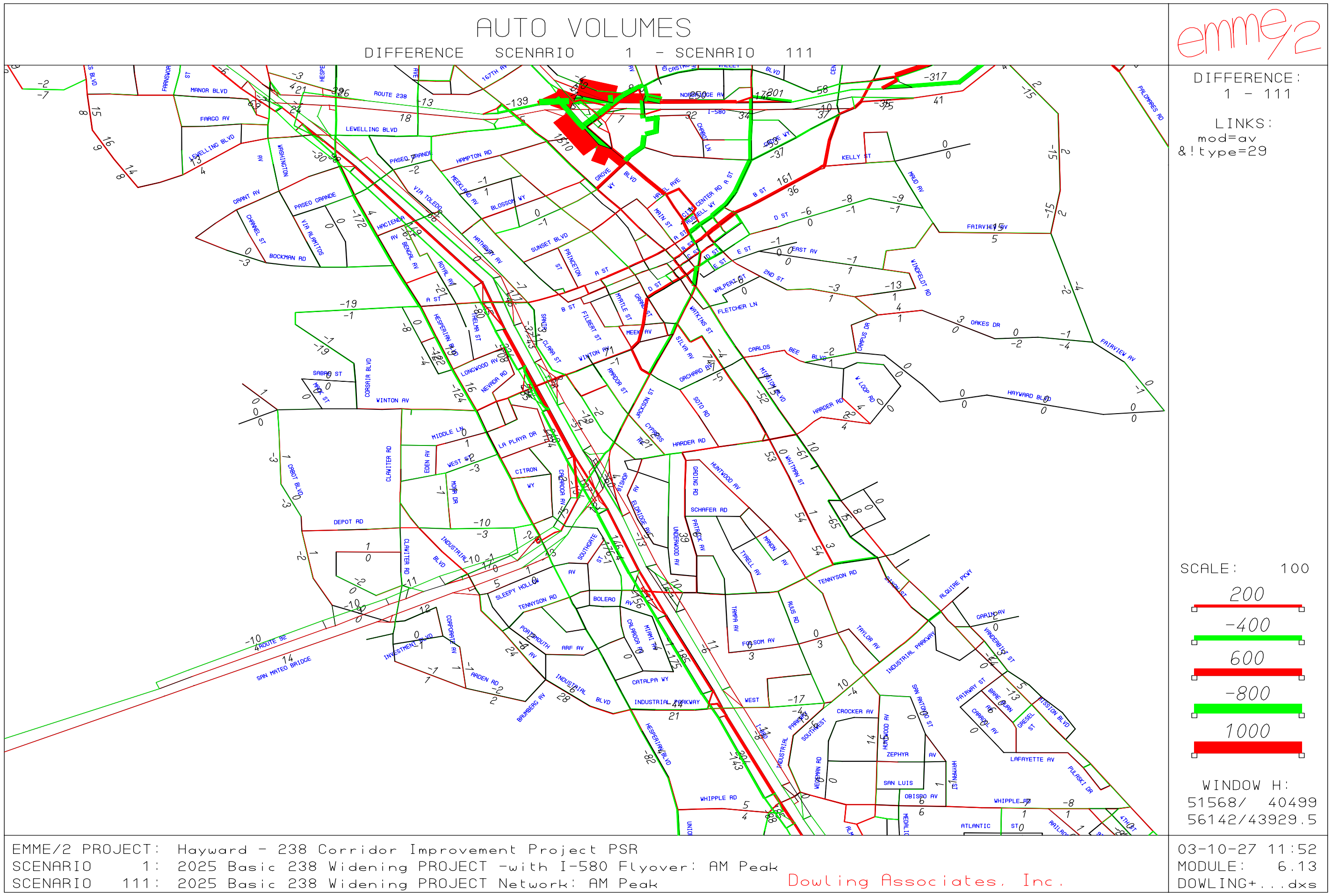


Exhibit 8 .Impact of I-580 Flyover Project Scenario on Base Project 2025 Forecasted AM Peak Hour Volumes.



III. Traffic Operations Analysis

The traffic operations analysis portion of this study is intended to characterize the existing operating conditions, operating conditions expected to occur in the future without the proposed project, and operating conditions in the future if the proposed project is constructed. Two basic methodologies were used to analyze the traffic operations along the corridor: intersection level of service analysis and microsimulation.

Intersection level of service analysis uses calculations established by the Transportation Research Board (TRB) in the Highway Capacity Manual (HCM). These calculations, using assumptions related to the number of lanes, type of traffic signal, volume of traffic, etc., translate known or expected traffic conditions into a simple "report card grade" for the intersection. These grades range from Level of Service A (LOS A), the best operating conditions, to LOS F, the worst operating conditions (see Exhibit 9 for definitions of levels of service). The City of Hayward, as with most cities, specifies certain inputs to the calculations, as well as what level of service grades are considered acceptable.

Microsimulation analysis uses highly sophisticated models run on computers to simulate what happens to vehicles as they proceed to their destination through an imaginary roadway network. The imaginary network is carefully constructed within the model to attempt to replicate actual conditions vehicles would experience. For this project, a computer program called VISSIM was used. In addition to the technical data that the program develops, it also provides an animated movie depicting the movement of vehicles on the roadway network. This movie currently shows only autos, but it can also show pedestrians, bicycles, and transit vehicles, if desired.

Existing Conditions

A total of 26 intersections were evaluated in this study. The City of Hayward provided historic traffic counts for several of the intersections where traffic counts had been conducted over the past two years. Traffic counts were then conducted as part of this study for any counts that were not available. Discrepancies between intersections in the counted traffic volumes on Foothill and Mission were "balanced" per City of Hayward instructions to within 10%. The Technical Appendix lists the specific adjustments made to each intersection count. The final balanced existing traffic volumes are shown in the TRAFFIX™ level of service computation sheets presented in the Technical Appendix.

Intersection Level of Service

The AM and PM peak hour level of service was analyzed for the Existing Conditions, No-Project, and the Project scenarios. The level of service was computed using the TRAFFIX™ program and the 1994 Highway Capacity Manual method as specified by the City of Hayward. City of Hayward default values for peak hour factor, percent trucks, etcetera were used unless superior information was available.

Exhibit 9. Level of Service Definitions

1994 Highway Capacity Manual Definitions of Signalized Intersection Level of Service

Level of Service	Stopped Delay Per Vehicle	Description
A	<= 5.0 seconds	Low delay, extremely favorable progression, most vehicles arrive on green, many do not stop at all.
B	> 5.0 and <= 15.0	Good progression, more vehicles stop.
C	> 15.0 and <= 25.0	Fair progression, individual cycle failures (some waiting vehicles cannot get through on green), number of vehicles stopping is significant.
D	>25.0 and <= 40.0	Congestion becomes noticeable, longer delays, unfavorable progression, higher volume/capacity ratios, many vehicles stop, individual cycle failures noticeable.
E	> 40.0 and <= 60.0	High delay values, poor progression, high volume/capacity ratios, frequent cycle failures.
F	> 60.0	Unacceptable to most drivers, oversaturation (more vehicles arrive in an hour than can be served in an hour), high volume/capacity ratios, many cycle failures, poor progression.

Sources: Table 9-1, 1994 Highway Capacity Manual, Transportation Research Board.

Actual cycle lengths and minimum green times for each phase were obtained from city provided Caltrans signal timing sheets for the intersections. A default 3 second per critical phase loss time was used to compute total intersection loss times. The loss times for Foothill/D Street and Foothill/Jackson/Mission were increased to reflect the longer all-red times coded for these two intersections in comparison to other intersections in the corridor.

All signals were coded as actuated and coordinated. Ten pedestrians per hour were assumed to cross each crosswalk. Based on Caltrans Truck Volumes Report for Route 238, heavy vehicles were estimated to account for 2% of the peak hour traffic.

Exhibit 13 below shows the results of the existing level of service calculations for the study intersections.

The existing conditions analyses were compared to those performed for the Hayward General Plan, and other recent traffic analyses for the corridor. The current analyses are consistent with these prior analyses taking into account the changes in traffic flows that have occurred in the corridor since the General Plan work was performed.

Microsimulation Model Calibration

The existing traffic counts and roadway geometry (including traffic signal characteristics) were used to create a simulation of existing conditions using the VISSIM program. The primary purpose of using the microsimulation tool for the existing conditions was to calibrate the model to prepare to analyze the future conditions. By properly calibrating the VISSIM model, it is possible to make reasonable estimates of future operating conditions when characteristics such as vehicular volumes or the number of lanes change.

Calibration of the VISSIM model consisted of a review of the turning patterns and link flows in the model, and a comparison of the VISSIM predicted travel times to field measured travel times for the corridor. Travel times were measured in the field using floating car runs made over a 2-week period in May 2003. The cars traveled the length of the corridor from Mattox to Industrial in the southbound direction, and from Industrial to the I-580 ramps in the northbound direction. The weather ranged from dry to light rain.

Exhibit 10 below summarizes the results. More detail can be found in the Technical Appendix.

Exhibit 10. Results of Field Measurements of Travel Time

AM Peak	Number of Runs	Mean (min:sec)	Standard Deviation (min:sec)
Northbound	10	13:43	4:29
Southbound	6	16:49	3:25
PM Peak	Number of Runs	Mean (min:sec)	Standard Deviation (min:sec)
Northbound	6	20:56	6:27
Southbound	9	15:00	2:07

The VISSIM model was run several times, each time collecting travel time data from the simulated vehicles. Various adjustments were made to the inputs of the model until the simulated travel time was reasonably close to the field conditions. Exhibit 11 below shows the results of the final set of runs for the calibrated VISSIM model.

Exhibit 11. Results of VISSIM Calibration Runs

AM Peak	Number of Runs	Mean (min:sec)	Standard Deviation (min:sec)
Northbound	10	14:33	00:14
Southbound	9*	17:43	01:00
PM Peak	Number of Runs	Mean (min:sec)	Standard Deviation (min:sec)
Northbound	10	23:30	00:57
Southbound	10	16:52	00:34

* One extreme run of 27 minutes excluded from results

The mean travel time results for the calibrated VISSIM model are well within the 95% confidence interval for the field measured mean results for the AM peak hour and for the Northbound PM peak hour (see Exhibit 12 below). The difference of the means for the Southbound PM peak hour is 01:52 (min:sec) while the 95% confidence interval is 01:36 (min:sec).

Exhibit 12. Two-sided "T" Test for Difference of VISSIM and Field Means

Peak	Direction	Difference of Means (min:sec)	95% Confidence Interval (min:sec)
AM Peak Hour	Northbound	00:50	03:10
	Southbound	00:54	03:25
PM Peak Hour	Northbound	02:34	06:27
	Southbound	01:52	01:36

The calibration objective is for the difference of the means to be less than the 95% confidence interval.

Future Conditions

This section presents the traffic operations analysis results for the Year 2025 no-project and baseline corridor improvement project scenarios.

Intersection Turning Movement Forecasts

The traffic volumes used for the future analyses were developed using the output of the traffic forecasting effort described in Chapter II of this report above. The results from the future model runs were input into the TURNS program that produces the Furness Incremental adjustment process. Finally the results were input into an EXCEL spreadsheet. This was followed by a rigorous review and manual adjustment of the future furnessed turns to ensure results are consistent.

The Furness process involves the computation of control volume forecasts for each approach of the intersection based upon the raw model forecasts and an estimate of the likely error in the raw model forecasts. The likely error in the raw model forecasts is determined by comparing the model forecasts for the calibration year (2000) to actual traffic counts made in the field. This difference between the model estimate and the count is then added to the model forecast to obtain the target control volume for each approach. The equation below illustrates this computation.

Control volume = [Counts data] + [Future model volumes - Base model volumes]

Note that if the "Future minus Base" computation results in a negative value a warning message is generated and this term is set to zero. The resulting calculation will then simply equal the Counts value.

If the Future approach or departure volume is zero and the Base approach or departure volume is greater than zero, then the resulting computed approach or departure volume will be set to zero. This would be the case when a link is deleted in the Future model network, or a two-way link is converted to one-way. This ensures that Furness turn volumes won't be assigned to or from a deleted link.

Once the controlling approach and departure totals are known for the intersection, then the traffic count (for existing conditions) is factored up to match the controlling approach and departure totals.

The existing turn count is arranged in matrix form, with rows representing approach turn moves and columns representing departure destinations (left, through, right, u-turn).

The rows of the turn count matrix are first growth factored so that the sum of the entries in each row matches the desired controlling approach volume.

Then the column totals are computed and the ratios of the computed totals to the desired controlling departure volumes become the growth factors that are then applied to each entry in the columns.

This row and column factoring process (known as a Furness adjustment process) is repeated until the desired closure criterion is achieved (actual row and column totals are close enough to the target totals), or the maximum number of iterations set by the analyst has been reached.

The resulting turn move forecasts for the AM and PM peak hours were then reviewed for reasonableness and manually adjusted where it was judged that the furnessing process had caused unreasonably low or high turn movements.

The following changes were made to the No-Project and Project turning movements to account for left turn pockets that will be added to Foothill at "B" Street and "C" Street:

1. B Street: make NB left 54 vph in AM, and 252 vph in PM.
2. C Street: make NB left 119 vph in AM, and 142 vph in PM.

These values were taken from the "C" Street Study.

The final turning movement forecasts are shown in the Technical Appendix as part of the TRAFFIX™ level of service calculation sheets.

The Metropolitan Transportation Commission (MTC) regional travel demand model includes a peak hour spreading module that predicts how much the peak hour demand will spread in response to traffic congestion. The Hayward Travel Demand Model does not contain a peak-spreading module. When the Hayward Demand Model peak hour forecasts for 2025 are compared to those produced by the MTC model, the Hayward Model forecasts for a typical north south screen line are generally 5% greater than the MTC forecasts.

Consequently, to provide better consistency with the MTC model, the Hayward Model peak hour forecasts for 2025 have been reduced 5% to account for peak spreading. The forecasts with peak spreading are used in the level of service analysis.

Signal Timing Optimization

The signal timings for the No-Project and Project scenarios were optimized using the Synchro program. As noted previously existing signal timing plans were used for existing conditions and no further optimization was performed, since Caltrans has reportedly optimized the current signal settings.

The VISSIM simulation for the No-Project scenario was first reviewed to identify wasteful, uneven queuing across lanes on the side streets caused by predicted high left turn demands in 2025 and the lack of left turn signal protection for the side streets. Left turn phases were added to Grove, Hazel, and City Center to correct this situation for both the No-Project and Project scenarios. Synchro was then used to partition the network into signal coordination groups. The cycle lengths, splits, and offsets were optimized on a network-wide basis using Synchro. The resulting signal timings were input into TRAFFIX™ for the level of service calculations for the No-Project and Project scenarios.

Intersection Level of Service

Using the same methodology as for the existing volumes, intersection level of service was calculated for Year 2025 forecast volumes for conditions without the proposed project and with the proposed project.

The Hayward Travel Demand Model peak hour forecasts were reduced 5% to account for peak spreading (see discussion in Chapter on Forecasts). However, it is important to note that this 5% reduction for peak spreading does not fully account for the effects of capacity limits on downstream flow rates, as would happen in real life and in the VISSIM analysis. Any intersection reaching capacity would in real life prevent the full volume from arriving at the next intersection. The intersection level of service analysis is still useful, however, as it gives a clear sense of the increase in demand and/or the immediate benefit of changing an intersection's capacity.

Exhibit 13 below shows a comparison of Year 2025 intersection level of service with and without the project. The results indicate that the project will improve operating conditions as compared to the no project case at many intersections, and at others it will result in approximately the same level of service. At a few intersections, the level of service will worsen slightly – this result is not unexpected, given the significant increase in expected traffic volumes.

Exhibit 13. Existing and Future Year 2025 Intersection Level of Service

AM Peak Hour	Existing			2025 No-Project			2025 Project			Reduced ROW			Flyover Scenario		
Intersection	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C
Foothill & Mattox	D	37.4	1.003	F	75.5	1.123	F	87.7	1.144	F	80.4	1.128	D	38.0	0.957
Foothill & Grove	C	18.8	0.831	E	48.5	1.044	E	45.7	1.023	F	154.3	1.238	E	56.9	1.104
Foothill & Hazel	B	10.7	0.681	C	21	0.836	C	19.1	0.799	D	27.3	0.97			
Foothill & City Center	B	14.5	0.686	C	21.1	0.78	C	22.5	0.832	D	38.3	1.015			
Foothill & Russell	A	1.6	0.382	A	1.6	0.485									
Foothill & A	D	26.1	0.87	F	111.4	1.203	F	208.7	1.384	F	88.5	1.17	F	138.5	1.254
Foothill & B	C	16.8	0.823	F	65.2	1.113	D	36.5	1.005	E	52.2	1.047			
Foothill & C	A	3.6	0.660	C	16.8	0.912	B	9.2	0.760	B	8.5	0.791			
Foothill & D	D	36.3	1.026	F	165.7	1.292	F	78.9	1.102	F	68.5	1.129			
Mission/Foothill/Jackson	E	45.8	1.093	E	53.5	1.062	B	14.1	0.868	B	12.0	0.700			
Jackson & Watkins	D	31	1.002	F	119.6	1.296	E	44.6	0.803	F	61.1	0.955			
Mission & Fletcher	B	12.3	0.664	C	19.7	0.765	C	19.5	0.862	C	21.4	0.921			
Mission & Highland	B	13.4	0.785	C	23.5	0.931	C	15.5	0.796	C	17.4	0.869			
Mission & Carlos Bee	F	62.4	1.06	F	61.5	1.068	D	38.5	0.962	E	48.6	1.03			
Mission & Harder	D	28.9	0.864	F	64.6	1.125	F	85.6	1.190	F	102.3	1.237			
Mission & Sorenson	B	6.3	0.712	B	8.8	0.89	B	6.7	0.847	B	6.7	0.831			
Mission & Jefferson/Calhoun	D	25.1	0.885	F	176.9	1.301	D	34.2	1.000	D	30.3	0.977			
Mission & Hancock	A	3.9	0.692	B	6.8	0.757	B	5.6	0.762	B	5.4	0.765			
Mission & Tennyson	C	20	0.613	D	37.9	0.903	E	53.1	1.089	F	64.0	1.122			
Mission & Industrial	C	24.9	0.725	D	30	0.873	E	41.6	1.020	E	41.7	1.021			

PM Peak Hour	Existing			2025 No-Project			2025 Project			Reduced ROW			Flyover Scenario		
Intersection	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C
Foothill & Mattox	E	49.4	1.043	F	81.9	1.142	F	92.7	1.155	F	94.9	1.159	F	97.4	1.164
Foothill & Grove	D	30.9	0.98	F	71.7	1.098	E	44.6	1.026	F	110.7	1.198	E	55.4	1.072
Foothill & Hazel	D	26.3	0.96	E	57.9	1.101	E	41.9	1.028	F	93.4	1.193			
Foothill & City Center	C	19.1	0.829	E	56.4	1.139	E	55.6	1.094	F	131.8	1.289			
Foothill & Russell	A	2.8	0.539	A	2.6	0.649									
Foothill & A	E	51.7	1.082	F	191	1.357	F	177.9	1.379	F	214.7	1.433	F	187.2	1.393
Foothill & B	B	14.3	0.819	F	103.6	1.228	D	37.8	1.016	E	43.7	1.050			
Foothill & C	B	8.9	0.708	F	64	1.114	B	14.8	0.867	C	20.2	0.951			
Foothill & D	D	37	1.029	F	144.6	1.271	F	93.4	1.198	F	63.8	1.119			
Mission/Foothill/Jackson	F	79.8	1.162	F	211.2	1.418	C	15.1	0.823	B	13.3	0.756			
Jackson & Watkins	D	29.6	0.922	F	233.2	1.407	E	46.5	0.782	F	104.2	1.095			
Mission & Fletcher	C	16.9	0.699	C	15.9	0.887	C	24.7	0.853	D	36.4	1.004			
Mission & Highland	C	18.3	0.878	E	42.3	1.097	C	16.8	0.843	C	19.3	0.907			
Mission & Carlos Bee	E	57.4	1.09	F	91.1	1.178	E	43.8	1.006	E	55.2	1.063			
Mission & Harder	D	32.1	0.893	F	73.4	1.144	E	54.1	1.096	F	109.4	1.243			
Mission & Sorenson	C	15.1	0.807	C	21.5	0.98	B	14.6	0.905	B	14.2	0.893			
Mission & Jefferson/Calhoun	B	13.2	0.88	F	112.7	1.19	C	18.8	0.981	C	17.9	0.97			
Mission & Hancock	B	5.4	0.829	B	9.5	0.87	B	7.4	0.861	B	7.3	0.851			
Mission & Tennyson	C	20.6	0.751	E	48.8	1.048	D	33.4	0.986	E	44.8	1.043			
Mission & Industrial	D	27.4	0.651	D	27	0.832	E	55.8	1.042	E	51.5	1.021			

- The level of service calculations for existing conditions use a combination of available and new counts which have been balanced to represent typical 2003 conditions and incorporate actual existing Caltrans signal timings.
- Russell is closed under Project Scenario.
- Level of service analyses for all of the future scenarios (no-project, project, reduced ROW, and flyover) assume 5% peak spreading of peak hour demands.

Microsimulation Analysis

The VISSIM model was used to estimate the peak hour travel times for traffic along the corridor under both the project and no-project scenarios. As shown in Exhibit 14, the time it takes to travel the length of the corridor (between Mattox and Industrial Parkway southbound and between Industrial Parkway and the I-580 ramps northbound) will in most cases more than double between the existing conditions and the Year 2025, under no-project conditions. The project will reduce this travel time significantly, but it will not reduce it all the way back to existing levels.

The VISSIM model also determined that in the 2025 no-project case, about 10% of the peak hour demand forecasted by the City of Hayward EMME2 model could not be served during either the AM and PM peak hours. The "project" scenario reduced this backup of vehicles unable to enter the corridor during the PM peak hour by one-third (7% of the forecasted 2025 peak hour demand could not enter the corridor during the peak hours). This un-served demand would represent either trips that have to find other routes or further spreading of the peak hour.

The microsimulation analysis was also used to evaluate the initial conceptual design of the base corridor improvement project. The analysis determined that addition northbound lanes were needed on Foothill Boulevard approaching the I-580 ramps to better distribute the traffic. The analysis also showed that three rather than two lanes were needed to carry traffic from northbound Mission to northbound Foothill for the year 2025. These design changes were incorporated into the VISSIM analysis reported in Exhibit 14.

Exhibit 14. VISSIM Corridor Travel Time Results

	Existing	2025 No-Project		2025 Project	
	Minutes	Minutes	Change	Minutes	Change
AM Peak					
Northbound	15	35	133%	21	40%
Southbound	19	33	74%	23	21%
PM Peak					
Northbound	23	32	39%	23	0%
Southbound	17	35	106%	18	6%

Change = Future/Existing -1
Entries are minutes average travel time

Exhibit 15 shows the VISSIM predicted segment travel times in the southbound direction.

The Year 2025 No-Project southbound segment travel times are generally equal to or significantly higher than Existing, except for Segment 20 (Calhoun to Hancock) in the AM peak hour and Segment 11 (Fletcher to Highland) in the PM peak hour. These differences are due to differences in the signal coordination plans between Existing and No-Project. Overall, the corridor length travel times under No-Project are significantly greater than Existing for both the AM and PM peak hours.

Exhibit 15. VISSIM Predicted Segment Travel Times (Southbound)

Average Travel Times (minutes)

		AM Peak Hour			PM Peak Hour		
	Segment	Existing	No-Project	Project	Existing	No-Project	Project
SB	1 Mattox & Castro Valley To Grove Way	1.4	2.9	1.3	1.4	5.1	1.4
	2 Grove Way To Hazel Av	1.2	3.1	1.1	1.3	5.0	1.4
	3 Hazel Av To City Center Rd	1.0	3.0	0.7	0.9	3.9	1.5
	4 City Center Rd To Russell Way	0.5	1.4		0.3	2.0	
	5 Russell Way To A St	0.5	1.1	0.9	0.2	1.5	0.7
	6 A St To B St	0.7	0.9	0.5	0.3	1.4	0.7
	7 B St To C St	0.9	1.3	0.5	0.3	1.5	0.7
	8 C St To D St	1.1	2.2	0.8	0.7	2.2	0.8
	9 D St To Mission Blvd	0.7	1.4	0.8	1.3	2.2	1.0
	10 Mission Blvd To Fletcher Ln	0.9	1.8	0.7	1.0	1.0	1.0
	11 Fletcher Ln To Highland	0.9	1.5	0.6	0.9	0.7	0.6
	12 Highland To Carlos Bee	1.3	1.9	0.8	1.1	1.0	0.8
	13 Carlos Bee To Central	0.6	1.1	1.0	0.6	0.5	0.5
	14 Central To Berry	0.1	0.3	0.3	0.1	0.1	0.1
	15 Berry To Torrano	0.4	1.1	1.4	0.4	0.4	0.4
	16 Torrano To Harder	1.1	2.1	3.1	1.0	1.1	1.2
	17 Harder To Sorenson	1.1	1.2	1.0	1.1	1.2	1.2
	18 Sorenson To Jefferson	1.0	1.0		0.9	0.8	
	19 Jefferson To Calhoun	0.2	0.2	1.1	0.2	0.2	0.9
	20 Calhoun To Hancock	0.7	0.6	1.1	0.7	0.6	0.6
	21 Hancock To Tennyson	0.6	0.6	1.7	0.6	0.5	0.6
	22 Tennyson To La Vista Quarry	0.5	0.5	0.6	0.5	0.6	0.5
	23 La Vista Quarry To Valle Vista	0.4	0.4	0.6	0.4	0.4	0.3
	24 Valle Vista To Industrial	1.0	1.1	2.5	0.9	1.1	1.4
	Total Southbound	18.5	32.7	23.1	16.9	34.9	18.3

Entries are stop bar to stop bar mean travel times in minutes.

Exhibit 16 shows the VISSIM predicted segment travel times for the northbound direction.

The Year 2025 No-Project northbound segment travel times are generally equal to or significantly greater than Existing except for Segment 18 (Jefferson to Sorenson) and Segments 4, 3, and 2 (Russell to Grove) in the PM peak hour. Over the entire corridor length the No-Project travel times in the northbound direction are significantly higher than Existing. Individual segment times may vary due to differences in signal coordination plans between existing and no-project.

Exhibit 16. VISSIM Predicted Segment Travel Times (Northbound)

Average Travel Times (minutes)		AM Peak Hour			PM Peak Hour		
	Segment	Existing	No-Project	Project	Existing	No-Project	Project
NB	24 Industrial To Valle Vista	0.9	1.7	0.9	0.9	3.2	0.9
	23 Valle Vista To La Vista Quarry	0.4	0.9	0.4	0.5	1.5	0.4
	22 La Vista Quarry To Tennyson	0.3	1.0	0.5	0.7	1.2	0.5
	21 Tennyson To Hancock	0.6	1.6	0.7	1.4	1.4	0.8
	20 Hancock To Calhoun	0.8	2.2		1.6	1.6	
	19 Calhoun To Jefferson	0.2	0.4	0.8	0.4	0.3	0.8
	18 Jefferson To Sorenson	0.9	2.0	0.9	2.3	1.8	1.0
	17 Sorenson To Harder	1.4	3.4	1.4	1.9	2.5	1.3
	16 Harder To Torrano	0.7	2.5	0.7	0.8	1.8	0.6
	15 Torrano To Berry	0.5	2.4	0.5	0.8	1.7	0.6
	14 Berry To Central	0.1	0.4	0.1	0.2	0.4	0.2
	13 Central To Carlos Bee	0.9	2.6	0.8	1.4	1.8	1.1
	12 Carlos Bee To Highland	0.9	2.1	1.2	1.0	1.3	1.8
	11 Highland To Fletcher Ln	0.8	2.3	1.5	1.1	1.2	2.1
	10 Fletcher Ln To Foothill Blvd	0.7	3.3	1.6	1.0	1.9	1.9
	9 Foothill Blvd To D St	0.4	0.8	2.3	0.8	1.4	2.5
	8 D St To C St	0.4	0.6	1.1	0.5	0.9	0.9
	7 C St To B St	0.3	0.4	1.2	0.4	0.9	1.2
	6 B St To A St	0.5	0.6	1.2	0.6	1.1	1.2
	5 A St To Russell Way	0.2	0.2		0.3	0.3	
	4 Russell Way To City Center Rd	0.2	0.2	0.5	0.4	0.3	0.5
	3 City Center Rd To Hazel Av	0.6	0.8	0.6	1.5	1.0	1.0
	2 Hazel Av To Grove Way	1.1	1.4	1.1	2.6	2.2	1.2
	1 Grove Way To I-580 On-Ramp	0.5	0.8	0.6	0.6	0.7	0.6
	Total Northbound	14.5	34.6	20.6	23.5	32.1	23.2

Entries are stop bar to stop bar mean travel times in minutes.

The Year 2025 Project northbound segment travel times are generally significantly less than the no-project except for Segment 15, 16 (Torrano to Sorenson) and Segments 19 through 24 (Jefferson to Industrial) in the AM and PM peak hours. The project southbound times are significantly less than no-project except for Segments 9 through 6 (Mission to A) in both the AM and PM peak hours. Over the entire corridor length the Project travel times in the northbound and southbound directions are significantly lower than for no-project. Individual segment times may vary due to differences in signal coordination plans between project and no-project.

Street Closures With Project

The following side streets to Foothill and Mission were identified for closure by city staff for the VISSIM and TRAFFIX analyses for the base project:

- Apple Avenue (East Side Only)
- Russell Way
- First Street
- Armstrong Street
- “E” Street
- Devon Drive
- Kellogg Avenue
- Douglas Street
- Monticello Street

Closures of the less traveled side streets to Mission and Foothill will generally improve traffic flow and safety by reducing the number of intersections where conflicting flows can occur.

The closure of the intersection of the east side of Apple Avenue with Foothill Blvd. should result in negligible traffic diversion because of the lack of developed properties fronting this short side of Apple. Residents on the east side of Apple can use Oak Street to access Grove Way and Foothill Boulevard at the signal there. The signal at Grove and Foothill is forecasted to operate at level of service (LOS) “E” during the AM and PM peak hours, thus diverted traffic from the east side of Apple will experience delay entering Foothill.

The closure of the intersection of Russell Way with Foothill Blvd. will divert traffic to the signalized intersections of City Center and “A” Street with Foothill Boulevard. Currently about 70 vehicles per hour use Russell Way during the AM peak hour and 140 vehicles per hour during the PM peak hour. The signal at City Center is forecasted to operate at level of service (LOS) “E” during the PM peak hour, while the intersection of “A” Street is forecasted to operate at level of service “F”. Neither intersection would have spare capacity to absorb traffic increases, but traffic currently using Russell already goes through both of these intersections so the impacts of the street closure on these two intersections are expected to be minimal

First Street is currently one-way southbound leaving the intersection of Foothill and “C” Street. Closure of the First Street side at “C” Street would allow First Street to be made two-way. Residents on the segment of First Street north of “D” street would have right turn in and out access to “D” street under the proposed project. Left turns exiting First at “D” would have to be made as a series of rights, first onto “D”, then onto Foothill, and finally onto “C” Street. Residents wishing to return to First Street from Foothill and “D” would need to go past “D”, turn right at “C”, turn right at Second Street, and right again at “D” in order to get home.

The closure of Armstrong Street at Main Street would require that all access be made off of First Street and then “D” street. The conversion of the intersection of First and “D” into right turn in or out only would require residents of Armstrong to turn right onto First, left onto “E”, left onto

Second, and left on “D” in order to go west on “D” Street. Armstrong Street residents returning home from points east of Second Street would have to use “E” Street to access First Street and then Armstrong.

The closure of “E” Street at Foothill should significantly reduce traffic on “E” street, diverting this traffic to “D” Street. The “D” Street intersection is forecasted to be at LOS “F” with the corridor improvement project and would not have spare capacity to absorb the diverted traffic.

The closure of Devon Drive access to Mission Boulevard would require traffic to divert to Bel Aire and Bryn Mawr to access Harder Road and Mission. The intersection of Harder Road with Mission is forecasted to operate at level of service “F” during the AM peak hour and would not have spare capacity to serve the diverted traffic. The impacts might be reduced by allowing right turn access into and out of Devon at Mission.

The closure of Mission Boulevard access from Kellogg Avenue and from Douglas Street would divert left turning traffic to the intersection of Jefferson/Calhoun with Mission. Right turning traffic would be diverted to Calhoun, Broadway, or Webster Streets.

The closure of Mission Boulevard access from Monticello Street would divert traffic to the unsignalized intersection of Hancock Street with Mission.

Median Break Closures With Project

The following median break closures were identified by city staff for the conceptual project design:

- Cotter Way
- Palisade Street
- Central Avenue
- Berry Street (East Side)
- Torrano Avenue (West Side)
- Webster Street

These intersections were not counted nor analyzed in the TRAFFIX™ and VISSIM analyses so level of service impacts at these locations cannot be determined.

Median closures while impacting accessibility to land uses on the side streets are generally desirable on high speed arterials because the closures reduce left turn conflicts that can lead to collisions.

The closure of the median on Foothill at Cotter Way would allow only right turns into and out of this street. Drivers wishing to turn left into or out of this street would need to make U-turns at the nearest downstream signalized intersection on Foothill (Grove and Hazel). These intersections are projected to operate at LOS “E” with the project during either or both the AM and PM peak hours.

The closure of the median on Mission at Palisade Street would allow only right turns into and out of Palisade Street. Drivers wishing to turn left into or out of Palisade would need to use the intersection of Highland Boulevard. This intersection is projected to operate at LOS "C" with the project so would have adequate capacity to accommodate the diverted traffic.

The closure of the median on Mission at Central Blvd. and at the east side of Berry Avenue would allow only right turns in and out of these two streets. Drivers wishing to turn left into or out of these streets would need to use the unsignalized intersection at Torrano Avenue (east side). Left turning traffic would have to wait for breaks in the platoons of northbound traffic on Mission released by the signal at Harder. Delays may exceed 60 seconds per vehicle.

The closure of the median on Mission for the west side of Torrano Avenue would allow only right turns in and out of this street. Drivers wishing to turn left into or out of this street would need to use the unsignalized intersection at Dollar Street and Harder Road to access Harder and then use the signalized intersection of Harder on Mission to complete their left turns. Left turning traffic would have to wait for breaks in the platoons of westbound traffic on Harder released by the signal at Mission. Delays may exceed 60 seconds per vehicle.

The closure of the median on Mission for Webster Street would allow only right turns in and out of this street. Drivers wishing to turn left into or out of this street would need to use the signalized intersection at Calhoun Street to complete their left turns. This intersection is projected to operate at LOS "F" with the project so there would be inadequate capacity to accommodate the diverted traffic. The intersection of Jefferson/Calhoun however can be mitigated with the addition of left turn lanes for the side streets, thus providing adequate capacity for the diverted traffic from Webster Street.

Left Turn Lanes With Project

The following left turn lanes were identified by city staff for inclusion in the VISSIM and TRAFFIX analyses for the base project:

- Foothill & A Street: northbound and southbound left turns
- Foothill & B Street: northbound left turns
- Foothill & C Street: northbound and southbound left turns
- Foothill & D Street: southbound left turns

Operational Impacts and Recommendations

Foothill & A Street – The addition of northbound and southbound left turn movements at this intersection increases the volume/capacity ratio at this intersection by 5% during the morning peak hour. The southbound left becomes a critical movement during the AM peak hour. The southbound left is also critical in the PM peak hour, increasing the intersection v/c ratio during that time by 5%.

Foothill & B Street – The addition of a northbound left turn movement at this intersection increases the volume/capacity ratio at this intersection by 3% during the morning peak hour, because the northbound left becomes a critical movement during the AM peak hour. The left turn increases the v/c ratio during the PM peak hour by 7%.

Foothill & C Street – The addition of a northbound and southbound left turn movements at this intersection increases the volume/capacity ratio at this intersection by 7% during the morning peak hour, because the northbound left becomes a critical movement during the AM peak hour. The southbound left turn becomes critical during the PM peak hour and increases the v/c ratio during that time by 6%.

Foothill & D Street – The addition of a southbound left turn movement at this intersection increases the volume/capacity ratio at this intersection by 3% during the morning peak hour, and 4% during the PM peak hour because the southbound left becomes a critical movement during both the AM and PM peak hours.

Both the "A" Street and "D" Street intersections with Foothill are projected to be so far above 1.00 volume/capacity ratios in the year 2025 with the base corridor improvement project, that the elimination of the left turns on Foothill at both these intersections would not significantly improve peak hour operations at these intersections.

The intersections of "B" and "C" streets with Foothill both have adequate available capacity to accommodate the left turns from Foothill without causing the intersections to operate at level of service "F".

Left Turn Storage Requirements

The table below (Exhibit 17) shows the recommended design storage lengths for left turn pockets on Foothill and on Mission for the base project scenario. The recommended storage lengths are computed as the maximum of the design queues output by TRAFFIX for each peak hour, divided by the number of storage lanes, times 25 feet per vehicle. The design queue is the 95 percentile probability maximum back of queue computed assuming a Poisson arrival pattern.

For cases where the left turns use a shared left-through lane, the combined through and left turn queues are added together and divided by the total number of available left, shared left-through, and through lanes to arrive at the required storage length for each of the lanes.

Exhibit 17. Recommended Left Turn Pockets Lengths for 2025 Base Project

	Northbound App.				Southbound App.				Eastbound App.				Westbound App.			
N/S Street & E/W Street	AM Q	PM Q	L	Ft	AM Q	PM Q	L	Ft	AM Q	PM Q	L	Ft	AM Q	PM Q	L	Ft
1 Foothill & Mattox	21	24	2	300	31	46	3	375	n/a	n/a	n/a	n/a	66	59	2	825
2 Foothill & Grove	7	12	1	300	5	6	1	150	17	19	1	475	33	8	1	825
3 Foothill & Hazel	7	6	1	175	20	20	1	500	12	30	1	750	4	5	1	125
4 Foothill & City Center	3	6	1	150	19	36	1	900	6	14	1	350	2	5	1	125
5 Foothill & Russell	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6 Foothill & A	4	1	1	100	6	6	1	150	6	17	1	425	50	38	1	1250
7 Foothill & B	4	18	1	450	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	53	59	2	750
8 Foothill & C	9	11	1	275	8	7	1	200	18	34	2	425	n/a	n/a	n/a	n/a
9 Foothill & D	n/a	n/a	n/a	n/a	4	5	1	125	56	90	3	750	60	24	2	750
10 Mission/Foothill/Jackson	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4	3	1	100	52	51	3	425
11 Jackson & Watkins	30	26	1	750	10	22	1	550	9	18	1	450	29	22	1	725
12 Mission & Fletcher	17	19	1	475	7	19	1	475	4	6	1	150	15	7	1	375
13 Mission & Highland	3	4	1	100	6	14	1	350	8	10	1	250	4	5	1	125
14 Mission & Carlos Bee	10	13	1	325	26	45	2	575	19	13	2	250	49	13	2	625
15 Mission & Central	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
16 Mission & Berry	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
17 Mission & Torrano	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
18 Mission & Harder	27	29	1	725	13	10	1	325	44	40	3	375	25	28	3	225
19 Mission & Sorenson	5	13	1	325	n/a	n/a	n/a	n/a	8	16	2	200	n/a	n/a	n/a	n/a
20 Mission & Jeff./Calhoun	3	2	1	75	7	8	1	200	19	29	1	725	4	0	1	100
22 Mission & Hancock	3	2	1	75	1	3	1	75	0	0	1	0	7	8	1	200
23 Mission & Tennyson	33	33	2	425	5	15	1	375	41	39	2	525	1	0	1	25
24 Mission & La Vista Quarry	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
25 Mission & Valle Vista	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
26 Mission & Industrial	39	21	2	500	12	18	1	450	29	51	2	650	3	3	1	75

AM Q = AM Peak Hour Queue (veh)

PM Q = PM Peak Hour Queue (veh)

L = Number of Left Turn Lanes

Ft = Storage Length (feet)

Intersection LOS Impacts of Project Variations

This section identifies the salient intersection level of service impacts of two variations to the full corridor improvement project: The I-580 westbound/Foothill Southbound Flyover, and the Reduced Right of Way project.

I-580 WB/Foothill SB Flyover

Adding the I-580 WB to Foothill SB flyover off-loads Foothill and Mattox by 13% during the AM peak hour (see Exhibit 18) while increasing AM peak hour volumes between Grove and Russell by 3% to 5%. The volume impacts elsewhere in the corridor are negligible.

The LOS analysis for Mattox shows that the flyover would improve the AM peak hour LOS from "F" to "D" (see Exhibit 13). The volume/capacity ratio drops from 1.14 to 0.96 during the AM peak hour.

The LOS analysis for Grove shows that the flyover would not significantly impact the AM peak hour LOS. It would stay at "E" with the corridor improvement project with or without the flyover. The AM peak hour volume/capacity ratio would increase from 1.02 under the improvement project to 1.10 with the flyover.

Elsewhere in the corridor the LOS impacts of the flyover variation of the project would be less.

The PM peak hour impacts on Mission and Foothill of the flyover are negligible.

Reduced Right Of Way Scenario

The reduced right of way provides 20% to 25% less through capacity than the full improvement project. The peak hour flows through the corridor are 6% less with the reduced right of way scenario than for the full improvement project due to the greater capacity constraint.

The reduced ROW project reduces capacity much more than the demand is reduced. Thus there are more LOS "F" intersections under the reduced right of way variation (see Exhibit 13).

Exhibit 18. Impacts of Project Variations on AM Peak Hour Forecasts

AM Peak Hour			Vehicles Per Hour			Percent of Project Volume		
Emme2#	North/South	East/West	Project	Flyover	Red. ROW	Project	Flyover	Red. ROW
3518	FOOTHILL	MATTOX	6,160	5,377	6,266	100%	87%	102%
3526	FOOTHILL	GROVE	8,364	8,779	8,199	100%	105%	98%
4260	FOOTHILL	HAZEL	7,568	7,806	7,397	100%	103%	98%
9801	FOOTHILL	CITY CTR	7,008	7,215	6,882	100%	103%	98%
9800	FOOTHILL	RUSSELL	6,003	6,175	5,728	100%	103%	95%
3522	FOOTHILL	A STREET	9,578	9,438	8,858	100%	99%	92%
3523	FOOTHILL	B STREET	9,130	9,194	8,191	100%	101%	90%
8983	FOOTHILL	C STREET	8,793	8,861	7,742	100%	101%	88%
9890	FOOTHILL	D STREET	10,916	10,804	9,983	100%	99%	91%
3579	MISSION	JACKSON	10,898	10,767	9,895	100%	99%	91%
3693	JACKSON	WATKINS	5,595	5,551	5,680	100%	99%	102%
3580	MISSION	FLETCHER	7,647	7,569	6,656	100%	99%	87%
9895	MISSION	HIGHLAND	7,290	7,225	6,323	100%	99%	87%
3545	MISSION	CARLOS B	9,013	8,959	8,076	100%	99%	90%
1	MISSION	CENTRAL	7,037	6,899	6,099	100%	98%	87%
3553	MISSION	BERRY	6,685	6,675	5,843	100%	100%	87%
8774	MISSION	TORRANO	6,755	6,718	5,882	100%	99%	87%
3546	MISSION	HARDER	8,075	8,069	7,481	100%	100%	93%
8777	MISSION	SORENSON	6,673	6,621	6,499	100%	99%	97%
4518	MISSION	JEFFERSON	0	0	0			
7959	MISSION	CALHOUN	7,206	7,154	7,028	100%	99%	98%
3547	MISSION	HANCOCK	6,086	6,102	6,018	100%	100%	99%
3548	MISSION	TENNYSON	7,300	7,299	7,201	100%	100%	99%
3554	MISSION	LA VISTA	5,080	5,095	5,031	100%	100%	99%
3555	MISSION	VALLE VIST	5,344	5,367	5,348	100%	100%	100%
3549	MISSION	INDUSTRIAL	6,435	6,370	6,432	100%	99%	100%
Total			186,639	186,089	174,738	100%	100%	94%

Exhibit 19. Impacts of Project Variations on PM Peak Hour Forecasts

PM Peak Hour			Vehicles Per Hour			Percent of Project Volume		
Emme2#	North/South	East/West	Project	Flyover	Red. ROW	Project	Flyover	Red. ROW
3518	FOOTHILL	MATTOX	6,413	6,404	6,421	100%	100%	100%
3526	FOOTHILL	GROVE	8,797	8,989	8,526	100%	102%	97%
4260	FOOTHILL	HAZEL	7,965	7,979	7,689	100%	100%	97%
9801	FOOTHILL	CITY CTR	7,390	7,363	7,147	100%	100%	97%
9800	FOOTHILL	RUSSELL	6,323	6,320	5,923	100%	100%	94%
3522	FOOTHILL	A STREET	9,717	9,719	9,393	100%	100%	97%
3523	FOOTHILL	B STREET	9,044	9,009	8,376	100%	100%	93%
8983	FOOTHILL	C STREET	9,424	9,568	8,605	100%	102%	91%
9890	FOOTHILL	D STREET	10,854	10,767	9,874	100%	99%	91%
3579	MISSION	JACKSON	11,487	11,375	10,444	100%	99%	91%
3693	JACKSON	WATKINS	5,509	5,468	5,816	100%	99%	106%
3580	MISSION	FLETCHER	7,987	7,973	6,961	100%	100%	87%
9895	MISSION	HIGHLAND	7,680	7,670	6,667	100%	100%	87%
3545	MISSION	CARLOS B	8,616	8,623	7,649	100%	100%	89%
1	MISSION	CENTRAL	6,558	6,567	5,601	100%	100%	85%
3553	MISSION	BERRY	6,553	6,604	5,638	100%	101%	86%
8774	MISSION	TORRANO	6,643	6,665	5,696	100%	100%	86%
3546	MISSION	HARDER	8,099	8,113	7,354	100%	100%	91%
8777	MISSION	SORENSON	6,885	6,868	6,708	100%	100%	97%
4518	MISSION	JEFFERSON	0	0	0			
7959	MISSION	CALHOUN	7,048	7,034	6,949	100%	100%	99%
3547	MISSION	HANCOCK	6,521	6,519	6,434	100%	100%	99%
3548	MISSION	TENNYSON	7,532	7,529	7,458	100%	100%	99%
3554	MISSION	LA VISTA	5,151	5,148	5,063	100%	100%	98%
3555	MISSION	VALLE VIST	5,618	5,630	5,548	100%	100%	99%
3549	MISSION	INDUSTRIAL	6,746	6,753	6,674	100%	100%	99%
Total			190,560	190,657	178,614	100%	100%	94%

IV. On-Street Parking and Parking Enforcement

Since a major component of the proposed Corridor Improvement project is to introduce parking prohibitions during peak periods, one of the tasks of this study was to estimate the number of vehicles that would be affected by the prohibitions.

Parking Occupancy Survey

A parking occupancy survey was conducted on Wednesday May 21, 2003 and again on Wednesday May 28, 2003 along the Route 238 corridor from Mattox Road to Industrial Parkway. The surveys were performed during the AM peak period between 7:00 and 9:00 AM and then again during the PM peak hours from 4:00 to 6:00 PM. These two time frames were chosen in order to determine the number of vehicles that would be displaced should the parking lane be removed or restricted during the peak hours.

The surveys were conducted by noting the license plate numbers of parked vehicles in each parking space along the entire corridor every 20 minutes during the observation period.

The SR 238 corridor was broken down into 22 segments in the northbound direction and 21 segments in the southbound direction in order to understand the parking occupancy on a block-by-block basis. Each segment consisted of a section between two study intersections (i.e., those that were studied under the Traffic Operations Analysis portion of this study), all of which are signalized with the exception of Central, Berry, and Torrano.

Over the entire length of the study area, 184 cars were parked during the AM peak hours and 420 vehicles were parked during the peak hours. The average dwell time for the AM peak period was 56 minutes while the PM peak hour dwell time averaged 1 hour and 1 minute. While the difference in average dwell time is less than appreciable, the difference in volume is significant with the PM parking occupancy at 2.3 times that of the morning occupancy. The volume difference is expected, given that more businesses are open during the PM peak period than the AM peak period.

While the magnitude varied, the higher parking occupancy was consistent when the data for the entire route was broken down into three separate segments: Industrial Parkway to Harder Road; Harder Road to Jackson Street; and Jackson Street to Mattox Road.

- Between Industrial Parkway and Harder Road, there were a total of 50 parked cars observed in the AM period and 100 cars in the PM period. The average dwell time for this section was 1 hour and 5 minutes in the AM peak and 56 minutes in the PM peak.
- Within the central portion of the study area, between Harder Road and Jackson Street, a total of 74 parked vehicles were observed in the morning peak and 154 in the evening peak. The average dwell time for this section during the AM peak is 54 minutes and 1 hour and 12 minutes during the PM peak.

- The northern section of the study area, between Jackson Street and Mattox Road, represented the highest volume of parked vehicles in the PM peak hour. Within the northern section, a total of 60 vehicles cars were counted during the AM peak period and 166 were counted during the PM peak period. The average dwell time for this period was 49 minutes during the morning peak and 56 minutes during the evening peak.

While the number of vehicles roughly doubled in the PM time frame along the corridor, the area did not experience any significant shift in parking from one area to another from the AM to the PM peak periods.

A detailed tabulation of parking occupancy for the individual sections is provided in Exhibit 20.

Recommended Parking Enforcement

Enforcement of the parking prohibitions is an important consideration if the operational benefits of the corridor improvement project are to be maximized. If parking lanes are to be opened up to through traffic during the morning and evening peak hours then it is crucial that all parked cars be cleared from the parking lane by the start of each peak period. A single illegally parked car can thwart the capacity benefits of peak hour parking prohibitions.

The City of San Francisco provides an example of an effective parking enforcement program designed to ensure that peak hour parking restrictions are obeyed. The City Department of Parking and Transportation (DPT) manages and operates their parking enforcement program.

San Francisco enforces its peak period parking restrictions through the use of roving tow trucks operated by City Tow, an independent contractor. Each tow truck includes one driver and one 'Checker' (a DPT employee), and each segment of the city with peak parking restrictions is assigned from 1 to 3 trucks depending on the area size. Each day, the tow trucks constantly rove throughout their assigned area during the peak hours, which are between 7 and 9 AM and either 3-6 PM or 4-7 PM depending on the area. City Tow is paid directly by the vehicle owners for the release of their towed vehicles. Vehicle owners must also pay the citation amount either at DPT or at City Tow. However, towing charges can only be paid at City Tow.

It is recommended that the City of Hayward adopt a similar pro-active parking enforcement program to ensure that the parking lanes on Foothill and Mission are available to through traffic during the rush hours.

Impacts of Recommended Parking Enforcement Program

Failure to implement a pro-active parking enforcement program along Foothill and Mission will result in the loss of 20% to 25% of the projected peak hour capacity improvements associated with the corridor improvement project. In effect, one lane in each direction would be lost to through traffic if one parked car were to remain in the parking lane in each block during the rush hours.

Exhibit 20. Detailed Parking Occupancy Survey Results

#	Location	AM Peak Period (7-9 AM) Total Veh.	AM Peak Period (7-9 AM) Avg. Dwell Time	PM Peak Period (4-6 PM) Total Veh.	PM Peak Period (4-6 PM) Avg. Dwell Time
Southern Section: Industrial to Harder					
1	Industrial to Valle Vista	3	0:40	14	0:36
2	Valle Vista to Tennyson	5	1:07	5	0:45
3	Tennyson to Hancock	17	1:44	29	1:13
4	Hancock to Calhoun/ Jefferson	11	0:54	32	0:54
5	Calhoun/Jefferson to Sorenson	13	0:43	14	0:19
6	Sorenson to Harder	1	0:15	6	0:20
	Subtotal Southern Section:	**50**	**1:05**	**100**	**0:56**
Central Section: Harder to Jackson					
7	Harder to Torrano	33	0:57	52	1:24
8	Torrano to Berry	15	0:44	43	1:01
9	Berry to Central	2	1:00	9	1:18
10	Central to Carlos Bee/ Orchard	4	0:26	11	1:16
11	Carlos Bee/Orchard to Highland/ Sycamore	18	0:43	30	1:23
12	Highland/Sycamore to Fletcher	2	0:15	9	0:15
13	Fletcher to Mission/ Jackson/ Foothill	0	0:00	0	0:00
	Subtotal Central Section:	**74**	**0:54**	**154**	**1:12**
Northern Section: Jackson to Mattox					
14	Mission/Jackson/Foothill to D	0	0:00	0	0:00
15	D to C	1	0:30	9	0:45
16	C to B	2	0:22	12	0:32
17	B to A	24	0:51	51	0:51
18	A to City Center	5	0:39	37	0:55
19	City Center to City Center/Hazel	7	0:27	14	0:46
20	City Center/Hazel to Grove	21	1:13	43	1:02
	Subtotal Northern Section:	**60**	**0:49**	**166**	**0:56**
	Total all Sections:	**184**	**0:56**	**420**	**1:01**

V. Traffic Collisions

Five years of traffic collision data provided by the California Highway Patrol was reviewed for this study. This data represents reported collisions, so there were likely more collisions than in this database

Collision History

For the entire study corridor, there were 1,134 reported collisions between January 1998 and December 2002, or about 45 collisions per mile per year. Two of the collisions resulted in fatalities: one in November of 1999 at Mission/Hancock in which two people were killed; and one in May of 2000 on Mission between Valle Vista and Tennyson in which one person was killed.

Rear end collisions were most common, with nearly half (46%) of the reported collisions of this type. The next most common collision was broadside collisions, making up 22% of all those reported. Thirteen percent of the reported collisions were sideswipes. None of the other collision types amounted to more than ten percent of the total.

The intersection with the most reported collisions was Mission/Tennyson, with 76 during the five-year period. This intersection ranked first for both head-on and broadside collisions as well. One intersection, Mission/Kellogg (located between Tennyson and Harder), had no reported collisions during the five-year analysis period.

Exhibit 22 shows a summary of the reported collisions for the study corridor.

Comparison to Statewide Average Experience

The Caltrans report, 2001 Collision Data on California State Highways, was consulted to obtain comparable statewide collision rate experience for similar facility types for comparison. Following the guidance in Part "B" of the Preface of this report, the Basic Average Accident Rate Tables for Highways, starting on page 84, were used for comparative purposes. The comparative rates are shown in Exhibit 21.

Exhibit 21. Basic Average Accident Rate Table for Intersections

Intersection Type	Rate Group	Base Rate	ADT Factor	% Fatal	% Injury
Urban Signals, 4-leg	I 14	0.43	0	0.4%	43.9%
Urban Stop & Yield Signs, 4-leg	I 12	0.22	0	0.7%	42.2%
Urban Signals, 3-leg	I 29	0.28	0	0.4%	43.3%
Urban Stop & Yield Signs, 3-leg	I 27	0.14	0	0.8%	42.4%

Source: 2001 Collision Data on California State Highways.

Exhibit 22. Reported Collisions by Intersection, 1998-2002

Route 238 Intersection	Total	Head-on	Sideswipe	Rear end	Broadside	Hit Obj	Overturn	Veh/Ped	Other
MATTOX RD/ CASTRO VALLEY	25	2	4	8	5	6			
ASH ST	6		1	3		1	1		
APPLE AV	14		3	4		7			
GROVE WY	68	2	6	37	12	4		3	4
COTTER WY	20		2	7	7	2			2
KIMBALL AV	11		1	6	3				1
OAKVIEW AV	2			1		1			
REX RD	10	1	2	4		3			
HAZEL AV	18	1	2	6	5	3		1	
CITY CENTER DR	42	1	4	21	9	2	1	2	2
RUSSELL WY	5	2	1	2					
A ST	26		3	14	6	1			2
B ST	48		4	20	19	2		1	2
C ST	41		1	21	13	1			5
D ST	30		8	16	2	2			1
MAIN ST	16		2	9	2	2		1	
MISSION BL/ FOOTHILL BL	32		6	21		3		2	
E ST	2			2					
FLETCHER LN	70		3	23	31	4	1	1	7
PINEDALE CT	40		8	18	6	3		3	2
SYCAMORE AV/ HIGHLAND BL	46	1	8	23	5	3		2	3
PALISADE ST	13		1	9	1	1	1		
ORCHARD AV/ CARLOS BEE BL	61		8	33	11	3	1	2	3
CENTRAL BL	14		1	5	5	3			
BERRY AV	28		7	11	7	2			1
TORRANO AV	35		6	17	8			2	2
DEVON DR	13		2	8	1	2			
HARDER RD	65		8	33	14	4		1	5
SORENSON RD	60		5	39	8	5			2
JEFFERSON ST	37		6	15	5	6		3	2
CALHOUN ST	9		1	4	2	1		1	
BROADWAY	11		1	7	1				2
DOUGLAS ST	1			1					
WEBSTER ST	10	1	2	3	2			1	1
HANCOCK ST	28	1	6	11	9	1			
MONTICELLO ST	6			1	3				2
TENNYSON RD	76	5	7	23	32	7	1		1
MARINERS CT	5			2	1	2			
VALLE VISTA AV	36		2	14	11	4		1	4
GREELY CT	3			1	1	1			
OVERHILL DR	5		2	1	1	1			
INDUSTRIAL PKWY./ ALQUIRE PKWY.	46	2	11	19	7	5	1		
Total	1134	19	145	523	255	98	7	27	56
		2%	13%	46%	22%	9%	1%	2%	5%

Exhibit 23. Actual Versus Expected Annual Collisions

Intersection North/South	East/West	Type	Rate Group	Annual MVM	Ave Annual Collisions	Actual Rate/MV	Expected Rate/MV	Better or Worse?
FOOTHILL	MATTOX	Urban, Signal, 4-leg	I-14	12,948,000	5	0.39	0.43	OK
FOOTHILL	GROVE	Urban, Signal, 4-leg	I-14	16,179,000	13.6	0.84	0.43	Worse
FOOTHILL	HAZEL	Urban, Signal, 4-leg	I-14	14,614,500	3.6	0.25	0.43	OK
FOOTHILL	CITY CTR	Urban, Signal, 4-leg	I-14	13,684,500	8.4	0.61	0.43	Worse
FOOTHILL	RUSSELL	Urban, Signal, 3-leg	I-29	11,119,500	1	0.09	0.28	OK
FOOTHILL	A STREET	Urban, Signal, 4-leg	I-14	16,756,500	5.2	0.31	0.43	OK
FOOTHILL	B STREET	Urban, Signal, 4-leg	I-14	14,952,000	9.6	0.64	0.43	Worse
FOOTHILL	C STREET	Urban, Signal, 4-leg	I-14	14,494,500	8.2	0.57	0.43	Worse
FOOTHILL	D STREET	Urban, Signal, 4-leg	I-14	18,495,000	9.2	0.50	0.43	Worse
MISSION	JACKSON	Urban, Signal, 4-leg	I-14	20,853,000	6.8	0.33	0.43	OK
JACKSON	WATKINS	Urban, Signal, 4-leg	I-14	11,835,000				
MISSION	FLETCHER	Urban, Signal, 4-leg	I-14	13,314,000	14	1.05	0.43	Worse
MISSION	HIGHLAND	Urban, Signal, 4-leg	I-14	12,460,500	9.2	0.74	0.43	Worse
MISSION	CARLOS B	Urban, Signal, 4-leg	I-14	15,045,000	12.2	0.81	0.43	Worse
MISSION	CENTRAL	Urban, Stop, 3-leg	I-27	10,467,000	2.8	0.27	0.14	Worse
MISSION	BERRY	Urban, Stop, 3-leg	I-27	10,044,000	5.6	0.56	0.14	Worse
MISSION	TORRANO	Urban, Stop, 4-leg	I-12	10,173,000	7	0.69	0.22	Worse
MISSION	HARDER	Urban, Signal, 4-leg	I-14	13,929,000	13	0.93	0.43	Worse
MISSION	SORENSON	Urban, Signal, 3-leg	I-29	12,090,000	12	0.99	0.28	Worse
MISSION	JEFFERSON	Urban, Signal, 4-leg	I-14	12,133,500	7.4	0.61	0.43	Worse
MISSION	CALHOUN	Urban, Signal, 4-leg	I-14	11,365,500	1.8	0.16	0.43	OK
MISSION	HANCOCK	Urban, Signal, 4-leg	I-14	11,596,500	5.6	0.48	0.43	Worse
MISSION	TENNYSON	Urban, Signal, 3-leg	I-29	13,164,000	15.2	1.15	0.28	Worse
MISSION	LA VISTA	Urban, Signal, 4-leg	I-14	10,297,500				
MISSION	VALLE VISTA	Urban, Stop, 3-leg	I-27	10,218,000	7.2	0.70	0.14	Worse
MISSION	INDUSTRIAL	Urban, Signal, 4-leg	I-14	13,441,500	9.2	0.68	0.43	Worse

Actual Collisions/Year	192.8
Expected Collisions/Year	122.6

Caltrans estimates that 100 percent of fatal accidents, 90 percent of injury accidents, and 40 percent of damage only accidents on state highways are reported to them. This is true of both the SWITRS (Statewide Integrated Traffic Records System), which was used to develop collision data for Route 238, and the Caltrans report used to develop comparable collision experience statistics. Consequently the statewide averages and the specific Route 238 data are comparable even though they both do not necessarily include all collisions occurring on the facilities.

The actual collision rates (annual reported collisions per million vehicles - MV) and the statewide average rates (expected) are shown in Exhibit 23. Route 238 currently experiences 192.8 average annual collisions per year at 24 intersections. If the collision rates at these intersections matched the statewide averages, then only 122.6 annual collisions would be expected.

Impacts of 2025 No-Project

The number of collisions in the corridor is a function of the number of vehicles using the corridor and the rate at which collisions occur. The collision rate may remain fixed in the future, but if the total volume goes up, the total annual collisions will also go up. Thus, our discussion of the likely future collision experience must focus both on changes in demand and changes in collision rates.

It is forecasted that AM and PM peak hour traffic demand in the corridor will increase by 33% over existing conditions between 2003 and 2025 under the No-Project scenario (see Exhibit 4). Given the capacity constraints of the corridor, it is unlikely that this increase in demand will translate into an increase in flow rates during the peak hours, however, it will probably result in a spreading of the peak to additional hours of the day, and result in a net increase in daily vehicle travel in the corridor.

Peak periods of congestion usually have greater collision rates due to the start and stop nature of queuing, however, the severity of the collisions tends to be less than for off-peak periods due to the lower speeds typical of congestion. Thus we would expect to see an increase in the rate of total collisions per million vehicle-miles and possibly a reduction in the percentage of the collisions that are severe (fatal or injury).

The minor capacity and safety improvements included in the No-Project scenario for Mattox, “B” Street, “C” Street, “D” Street, Carlos Bee, Harder, and Tennyson will likely improve collision rates at these locations. Similarly, the side street left turn protection assumed to be installed on Grove and Hazel should improve collision rates at these two intersections. These spot improvements however are unlikely to significantly affect overall corridor collision rates.

Thus the annual number of collisions in the corridor can be expected to significantly increase mostly due to the general increase in travel in the corridor and to a much less extent due to a possible increase in the general rate of collisions in the corridor.

Impacts of 2025 Corridor Improvement Project

The proposed project will include several safety improvements that will reduce the overall rate of collisions and the proportion of severe collisions in the corridor. They include:

1. The Mission/Jackson/Foothill Overpass
2. Closure of several side street intersections (Russell, Central, La Vista Quarry, Valle Vista)
3. Realignment of Jefferson/Calhoun intersection.

The Mission/Jackson/Foothill overpass will eliminate several conflicting turning movements at the intersections of Jackson with Mission and Jackson with Watkins thus improving both the collision rates and the proportion of severe collisions at these two intersections.

The closure of several side street intersections will reduce turning move conflicts at these intersections and thereby reduce the rate of collisions and the proportion of severe collisions at these locations.

The realignment of the intersections of Jefferson and Calhoun with Mission will consolidate two intersections into one thus reducing turn move conflicts at these locations and thereby reducing the rate of collisions and the proportion of those collisions that are severe.

The new left turn pockets on Foothill at “A” Street and at “D” Street that would be part of the proposed project may or may not increase collision rates at these intersections. Since left turns are currently prohibited from Foothill at these two intersections, the elimination of these prohibitions would increase the exposure of vehicles to left turn collisions. However, these new left turns may be left turns already being made at other intersections, thus an increase at these two intersections may be balanced out be decreases at other intersections on Foothill. The net effect may be a wash.

Thus the proposed project is expected to generally reduce the total rate of collisions in the corridor as compared to the no-project condition.

The proposed project however will also increase the peak hour travel demand in the corridor by about 25% over no-project (see Exhibit 4) for the year 2025. Again, given the capacity constraints of the corridor, it is unlikely that this increase in demand will translate into an increase in flow rates during the peak hours, however, it will probably result in a spreading of the peak to additional hours of the day, and result in a net increase in daily vehicle travel in the corridor.

The project, however provides more additional capacity than the additional demand expected to be attracted to the corridor by the project, thus it will reduce the duration of the peak periods of congestion which usually have greater collision rates due to the start and stop nature of queueing. This benefit may be reduced by an increase in the proportion of severe accidents during the longer off-peak periods.

Thus the proposed project is expected to reduce the overall rate of collisions in the corridor while increasing the annual number of vehicles using the corridor. The decrease in the collision rate opposed by the increase in vehicles may or may not result in a net decrease in total annual collisions in the corridor.

The new vehicles using the corridor presumably will come from other streets in the area, thus reducing the number of vehicles exposed to collisions on those streets. The net effect of the proposed project on a citywide basis consequently could be a net decrease in annual collisions within the City of Hayward, depending upon the collision rates on the streets where the traffic is being reduced by the project.

VI. Transit

Under Preparation.

VII. Bicycle and Pedestrian Travel

Under Preparation